ELECTROSTATIC POWDER COATING

Although the electrostatic powder coating process was developed in the late 1950’s and powder guns were marketed in the United States as early as 1960, it was not until 1965 that the process was fully utilised.

Since its inception it has gained acceptance as an appropriate industrial finish for a number of reasons:

- Economy is improved as the overspray can be collected and reused thereby reducing waste.
- Objects are easily coated irrespective of their shape.
- The hazard normally associated with wet spraying reduced as no solvents are used. In addition the ignition energies required to ignite a powder are 50 to 100 times greater than those needed to ignite a solvent vapour/air mixture.

The process

Powder is suspended in air, electrostatically charged by high voltage direct current and directed towards the workpiece which it evenly coats, the powder being retained by electrostatic forces. The workpiece is then cured in an oven to melt the powder into a permanent coating.

These are the various ways of applying the powder:

- **Spray application**

  This is possibly the most common method. Powder stored in a container is introduced into an air stream by means of a pneumatic ejector and fed through a single tube to a spray gun or series of spray guns which are either hand or machine held. A cable connects the gun to an electrostatic powder unit supplying between 30 and 100 kV direct current.

  The spray gun directs the powder towards an earthed workpiece where it is retained electrostatically.

  Spraying is normally carried out in a spray booth from which air is extracted and filtered to recover overspray powder which is then reused.

- **Fluidised beds**

  These consist of containers with solid sides, porous base and an open top. Air flows up through the porous base and through a quantity of powder causing it to fluidise. The workpiece which is earthed then passes over electrodes situated near the surface of the powder and the object is coated with powder electrostatically. An air extractor and filter are fitted to collect and recover any powder which may have become airborne.
• The cloud chamber

This is a box-like enclosure in which a powder cloud is continuously resent. Workpieces pass through the chamber on a conveyor and are coated with powder electrostatically.

Fire hazards

The possibility of an unwanted electrical discharge occurring in the presence of accumulated powder clouds in the spraying area may result in a fire. Other potential causes of fire include powder clouds coming into contact with ovens used for curing workpieces or metal objects passing through the air extraction system generating a mechanical spark which may ignite powder in the recovery unit.

Fire precautions

Powder storage

Powders when packaged are not considered hazardous and are stored under conditions suitable for ordinary combustible materials. Care should be taken when moving containers so that the possibility of breakage and the powder becoming airborne are minimised. Any spillage of powder should be cleared up immediately.

The coating operation

Powder coating machinery is designed to minimise the possibility of sparks discharging and igniting the powder being applied and also to prevent a fire propagating from the area of application to the powder recovery unit.

Automatic spraying with cyclone powder recovery. 80% of the overspray is recovered. A cartridge type recovery unit allows recovery of 100% of overspray.
The chances of fire will be reduced substantially if the following precautions are followed:

- Spray application should be conducted in a spray booth

- Air extraction facilities must ensure that air/powder mixtures are kept well below the lower limit of flammability and that all powder overspray is extracted.

- Suitable interlocks should be installed to ensure that:
  - powder is only supplied if the air extraction system is operating
  - the electrostatic power unit will only supply power if powder is being supplied

- Flameproof and dust proof equipment will be necessary in certain parts of the process

- The design of most electrical equipment precludes the discharge of a spark sufficient to ignite the powder cloud. However, where sparking due to the electrostatic charge has caused a problem it has been traced to misracking of parts of the conveyor or swinging of the conveyor rack.

- Power supply equipment should also be fitted with current limitation devices which will either prevent the chosen voltages being exceeded or will automatically isolate the power supply when the maximum current is reached.

  Certain manual application spray guns automatically reduce the voltage as the gun moves closer to the work piece, thereby preventing any sparking.

- Static discharge is avoided by earthing and bonding. This includes installing electrostatically conductive flooring and the wearing of conductive footwear by workers.

- The use of mesh at the exhaust intake to prevent the ingress of objects which may cause a spark and ignition is recommended.

- Where the spread of fire from spray areas to powder recovery units has not been physically prevented by design, the installation of explosion venting and a suitable damper in the duct may be necessary. This would normally only be applicable when powders are present in flammable concentrations and the possibility of explosion is likely.

- Care should be taken not to create a dust cloud when filling powder supply hoppers.

- Site preheaters and curing ovens well away from areas where dust clouds or layers of dust are likely to occur. Preheaters should be fitted with thermal cutouts to prevent the overheating of workpieces being prepared for powder application.
Use the following check to evaluate your powder coating installation

<table>
<thead>
<tr>
<th>FIRE SAFETY CHECKLIST</th>
<th>YES</th>
<th>NO</th>
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<tbody>
<tr>
<td>1. Is spray operation carried out in a spray booth?</td>
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<td>2. Has special electrical equipment been installed in hazardous areas?</td>
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<tr>
<td>3. Is earthing and bonding equipment fitted where static electricity may be a problem?</td>
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<td>4. Does air extraction and powder recovery remove all overspray powder?</td>
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<td>5. Have interlocks been installed for operation of ventilation, powder and power supplies?</td>
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<td>6. Are there explosion relief facilities incorporated on the powder recovery system?</td>
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<td>7. Has smoking and the use of open flames and other ignition sources been prohibited in or near this area?</td>
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<td>8. Are powder stocks neatly stored in a suitable storage area?</td>
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<td>9. Is the process equipment and area cleaned regularly?</td>
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<td>10. Have employees been trained in the use of fire equipment and what action to take in the event of fire?</td>
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References

Code of Practice, Application of Powder Coatings by Electrostatic Spraying, Paint Makers Association of Great Britain
Fire Prevention No. 100, Hazards Associated with electrostatic Powder Spraying FPA(UK)
Blackburn Heat and Air (Pty) Ltd, Kempton Park.